From: merhav@ee.technion.ac.il
Subject: Re: Your recent arXiv post 1507.01537 : Identifying Functional Thermodynamics ...
Date: August 14, 2015 at 3:07 AM
To: James P. Crutchfield chaos@cse.ucdavis.edu
Cc: Dibyendu Mandal dibyendu.mandal@berkeley.edu, Alexander Boyd abboyd@ucdavis.edu

I just saw your arXiv post that replies to my comment. I opted to post my comment in public, as I felt frustrated that in your revision, you have not addressed my concerns satisfactorily, and since you were not very responsive in e-mail, in general. Had I received descent answers in e-mail, I wouldn't have posted the comment.

To the facts of the matter, while I am (and was) aware of the differences between our models, I still think that your presentation is misleading the reader in the way it is presented (at least in the early stages of the presentation, and many readers don't read papers fully to see all the details), because you make strong statements on being the first to incorporate correlations, before your model is clearly presented, so this gives the impression that you were the first to incorporate correlations IN GENERAL, while you were not, at least as far as input correlations go. This is why I said that some of your statements are *misleading* (as opposed to being *wrong*, a word which I was cautious enough not use). I have deliberately used a simple model of a memoryless channel, because my emphasis in that work was different.

On the technical matters, as long as the channel satisfies eq. (3) (of your last post), then eq. (1) is valid. This is why I wrote in my comment "causal channel without feedback". `Without feedback'' means that there is no dependence on past outputs given the past inputs. As for computing bounds compared to exact quantities, correct me if I am wrong, but in classical thermodynamics, the second law gives a limitation that holds for WHATEVER protocol one may use to pass from one equilibrium point to another. In this case, the *exact* quantity one is interested in is the maximum extractable work (where the maximum is taken over all such protocols) is indeed incomputable, and the second law indeed gives a useful bound in terms of the free energy difference, which is extremely valuable. Here, on the other hand, the situation is different: The system model defines a specific, well-defined protocol, and at least for the various models that I am familiar with (in the context of information thermodynamics), it is quite easy to calculate the work, and it depends only on the input and output marginals, so the role of the entropy difference as a BOUND is not as strong here as in classical thermodynamics and statistical mechanics.

Sincerely,
Neri Merhav

Quoting merhav@ee.technion.ac.il:

> Gentlemen,
>
> FYI, the attached document will be posted on arXiv on Tuesday, August 4th. I would like to stress that my critique does not reduce the value of the paper in any other aspects.
>
> Sincerely,
> Neri Merhav
>
> Quoting merhav@ee.technion.ac.il:
>
> > Dear Prof. Crutchfield,
> >
> > Thank you for this update. The new version indeed reads better, but it is still a bit misleading.
> >
> > You write: "Other bounds that account for correlations have been analyzed in the context of a memoryless channel driven by a memoryful process [57]."
> >
> > Well, first of all, it is not really *other* bounds in section 4 of [57]. It is the very *same* bound (with the only exception that I didn't take the limit over l). Secondly, as I already said in my second e-mail from July 17 (the P.S.), although I had a memoryless channel in mind throughout [57], it takes just a minute to realize that the derivation of the bound in section 4 therein is valid as is, not only for memoryless channels, but for every causal channel without feedback (which actually means in full generality), namely, every channel of the form p(y_1,...y_n|x_1,...,x_n)= \prod_{i=1}^n p(y_i|x_1,...,x_i) (where the x's are the channel inputs and the y's are the channel outputs, in my notation), so it is fair to say that the bound in [57], which preceded yours, is even more general.
> >
> > Sincerely,
> > Neri Merhav
> >
> > Quoting "James P. Crutchfield" <chaos@cse.ucdavis.edu>:
> >
> > > Dear Prof. Merhav,
> > >
> > > A new version of arXiv 1507.01537 appeared several days ago.
> > > It deletes the original reference to your arXiv paper.
> > > It includes a sentence later that cites it, pointing out that it considers memoryless transduction of correlated input.
> > > The citation itself was updated to indicate it has been published.
> > >
> > > These address the substantial concerns you raised.
> > >
> > > Sincerely,
> > >
> > > James P. Crutchfield, Professor
> > >
> > > Complexity Sciences Center Director
> > > Physics, University of California, chaos@ucdavis.edu

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